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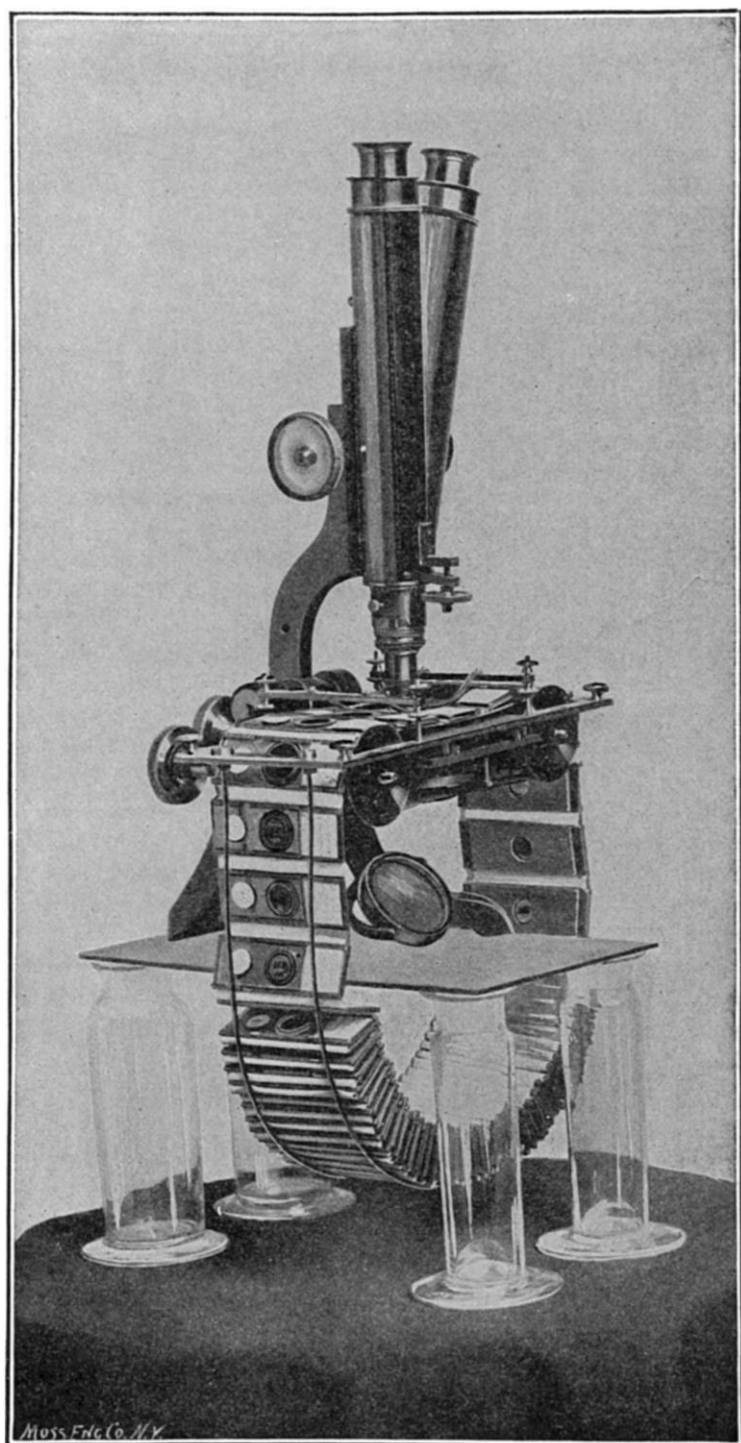
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APPARATUS FOR THE EXHIBITION OF MICROSCOPIC OBJECTS.

Dr. JAMES M. FLINT, United States Navy.

I desire to bring to your attention some mechanical devices for public and class exhibition of microscopic objects. Every one who uses the microscope, whether as one of the tools of his profession, as a necessary aid to instruction in the various branches of natural science, or only as a source of intellectual amusement, finds it his duty or his pleasure to exhibit the treasures of his cabinet. You all know how exhaustive of time, patience, and physical endurance is this work of exhibition. To avoid this fatigue and loss of time and to enable the microscopist to show a series of objects without constant personal supervision, I have constructed the apparatus shown in the accompanying plates.

The first is a special device for the exhibition of a particular class of objects to the general public. The objects consist of a series of foraminifera, selected from the deep-sea dredgings made by the United States Fish Commission steamer "Albatross" along our Atlantic coast. They are best viewed as opaque objects, and require only moderate magnification for their determination. It was early found that for the thorough study of these minute shells no method was so satisfactory as mounting them upon small blackened disks, with a short stem for insertion in Beck's disk-holder, an accessory with which you are all probably familiar, contrived so as to give rotation to the objects attached to the disk around both a perpendicular and a horizontal axis, thereby making it easy to examine every side of a specimen except that actually resting upon the disk. To save time, a number of these disks were arranged upon a circular plate of pasteboard six inches in diameter, supported and revolving upon a pivot attached to the mechanical stage of a large microscope. This device was exhibited before the Biological Society of Washington, and a description of it appeared in the American Microscopical Journal in June, 1886.



Moss Eng. Co. N.Y.

This machine is an enlargement of the one just mentioned, with such modifications as to secure the specimens from possibility of injury from inexpert manipulation. It consists of a circular plate of aluminum 16 inches in diameter and one-eighth of an inch thick, perforated with concentric rows of holes for the insertion of the stems of the little brass disks which hold the specimens. The aluminum plate revolves upon a pivot which itself rests upon a slide moved by a rack and pinion. Rotation is effected by means of a steel rod, terminated by a light spring, on the end of which is a small crescentic projection. This projection fits into corresponding notches made in the under surface of the plate, and when the rod is pushed steadily in as far as it will go, by means of the knob at the right of the case containing the apparatus, the plate is caused to revolve until one of the brass disks is brought exactly into the field of the microscope. Releasing the knob, the rod is carried back to its original position by means of a coiled-wire spring, and the projection on the end of the rod engages the next notch. The successive rows of objects are brought into view by turning the milled head on the left side of the case, which operates the slide supporting the metal plate. The whole apparatus is enclosed in a dust-tight box, secured by a lock, the only parts exposed to manipulation being the knob attached to the rotating rod and the milled head which acts upon the slide. The top of the box is of plate-glass, and upon this rests the microscope, the objective of which projects through a hole in the glass. Only the coarse focal adjustment is necessary, and the movement is limited by stops, so that the objects cannot be entirely lost to view.

This instrument has received a good practical test of its endurance, having been left without supervision for several weeks in a public place, where it was handled at will by men, women, and children.*

Certain modifications of the apparatus would at once suggest themselves if it were to be used only by experts or by classes of intelligent students, as, for instance, giving the motion of rotation by means of a friction roller instead of the rod; but in designing this for public use simplicity was of the first importance.

It is easy to see that this form of rotary stage might be adapted for the display of transparent objects, it being only necessary to make

* This apparatus is similar to that of Dr. Taylor, figured on page 31, except that it is enclosed in a glass box with the eyepieces and part of the tube projecting from the top.

holes through the metal plate large enough for the transmission of the required light. The objection to this form is that it would require the mounts to be upon small squares of glass instead of the regulation slides, 1 by 3 inches.

The desirability of being able to exhibit a series of objects mounted in the usual way upon glass slips of standard size has led to the invention of the other device, which I show you in its experimental form and not exactly as I would recommend it for class or public use. The key to the invention is the automatic folding of the slides when attached to a flexible ribbon. As will be seen, the fall of a slide throws the band or ribbon out of the perpendicular, so that gravity naturally causes the next slide to fall in the opposite direction. By securing a number of slides to an endless band of linen and causing them to fall into the concavity of a semicircular support, it happens that piling up on one side of the semicircle and being released on the other, when the preponderance reaches a certain degree the whole mass slips gently around toward the point of least resistance. It only remains then to provide for the passage of the ribbon beneath the microscope. This is accomplished by means of two rollers connected by bands or belts of leather over which the ribbon is made to pass, rotation being effected by means of a milled head attached to the pivot of one of the rollers. The elasticity of the leather bands holds the slides gently pressed against two fixed guides above, thereby maintaining the upper surface of the slides at a uniform distance from the objective of the microscope as they pass under it. The rollers, together with the wires supporting the folded slides, are borne by a brass plate which has a sliding fore-and-aft movement upon the bed-plate, resting upon the proper stage of the microscope. This sliding motion is controlled by a screw, the head of which is conveniently near the one which turns the rollers. By these two movements we have the conveniences of a mechanical stage, and one slide after another may be brought into the field of view with the upper surface of each slide always at the same focal distance from the microscope.

For class purposes it would be better that the apparatus for carrying the slides should be entirely independent of the microscope. It might be enclosed securely in a box with the top and one side of glass and the microscope secured above as in the other instrument shown.

Two or three essentials in construction should not be overlooked. Enough slides must be attached to the ribbon to a little more than

fill the curve of the sustaining wire. The ribbon should contain a little sizing so as to hold the fold, or rather the tendency to fold, in a certain direction, and an even number of slides should be put on in order not to reverse the fold at every complete revolution of the ribbon.

The slides may be glued directly upon the ribbon or be secured by means of something like the thin brass slide-holders used with the instrument before you.

The principal applications of this contrivance are obvious. For the teacher of botany, for instance, a series of slides illustrative of vegetable histology, arranged in this way, would certainly prove most instructive and interesting to his classes. They would be convenient for frequent and leisure examination, would be secure from injury, and the necessary skill in manipulation of the instrument could be acquired in a very few minutes by the pupil of sufficient intelligence to study botany. The geologist might have his type series of rock sections for his own as well as for class study. The entomologist might bring to light some of the treasures that lie hidden year after year in his neat but neglected boxes. But more especially could the all-around microscopist get together a set of miscellaneous slides of a popular character which would prove an exhaustless source of entertainment for his friends, as instructive and delightful and much more rare than a portfolio of artist's proof engravings.